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1984 BREEDING BIRD SURVEY OF LAKES POYGAN, WINNECONNE, AND BUTTE DES MORTS, WISCONSIN

by Michael J. Mossman, Sumner W. Matteson,
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SUMMARY

During the 1984 breeding season we surveyed Lakes Poygan, Winneconne, and Butte des Morts, in Winnebago and Waushara counties, Wisconsin to obtain baseline data on breeding birds and to determine the status of various critical species. At least 77 species probably nested in the study area, including several state-listed endangered, threatened, and watch species. We located a total of 312 pairs of Forster's terns (Sterna forsteri) that included 2 unsuccessful colonies on natural substrates and 5 successful colonies on artificial nesting platforms. Common terns (S. hirundo) nested here in the 1960's but did not nest in 1984. We discovered Wisconsin's only known inland colony of ring-billed gulls (Larus delawarensis) (327 pairs), at the possible site of a former common tern colony. A total of 95 herring gull (L. argentatus) pairs nested on riprap islands and barriers; this represents the state's largest inland nesting concentration of this species. Marshes along the lake edges provided habitat for many wetland birds, including at least 145 nesting pairs of black terns (Chlidonias niger). A lowland hardwood tract along the Pine River contained a number of unusual and "watch"species, including yellow-bellied sapsucker (Sphyrapicus varius), brown creeper (Certhia americana), acadian flycatcher (Empidonax virescens), cerulean warbler (Dendroica cerulea), and northern waterthrush (Seiurus noveboracensis). We recommend a continuation of the Forster's tern platform program, protection of lakeshore marshes, riprap islands, and the Pine River swamp, a reconsideration of water level management in the Lake Winnebago system, and periodic monitoring of bird populations and habitat conditions.

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INTRODUCTION

We conducted an extensive survey to document the breeding bird fauna occurring within a chain of 3 lakes: Poygan, Winneconne, and Butte des Morts. The area surveyed included adjacent marshes and lowland woods. This area is of particular interest because of its colonies of Forster's terns[3] (endangered in Wisconsin), the first colony here being recorded in 1977. The breeding population has since expanded with the development of an artificial nest platform program, but there has never been a thorough survey of the lakes and marshes to determine the distribution of Forster's terns nesting on natural substrates outside of the platform sites.

Common terns (endangered in Wisconsin) nest on Lake Winnebago within 20 km of the study area. Unpublished records of common terns nesting on Lakes Butte des Morts and Winneconne in the 1960's led us to suspect that the species might still nest on some of the rocky islands that occur in the 3 lakes. We undertook the survey to determine this species' nesting status in the study area, and to evaluate potential nesting habitat.

Little is known of nesting gulls at Wisconsin sites away from the Great Lakes. Because the ring-billed and herring gulls are potential nest-site competitors with common terns in Wisconsin, a survey of potential tern nesting habitat would be incomplete without information on the nesting status and distribution of the 2 gull species.

Double-crested cormorants (threatened in Wisconsin) have been recorded on the lakes in recent summers. Statewide, this species has increased markedly since the early 1970's and has expanded its breeding range. We needed to determine its breeding status here.

Other species of interest include the black tern (a Wisconsin "watch" species) and great egret (threatened), for which statewide surveys are being completed, and other "watch" species such as great blue heron, black-crowned night-heron, American black duck, northern harrier, king and yellow rails, and acadian flycatcher.

Although endangered, threatened, and "watch" species were of special interest, we also took the opportunity during this survey to document the breeding bird fauna of the immediate Poygan-Winneconne-Butte des Morts area. The survey not only provides information on the current and potential nesting status of critical and other nongame species, but serves as baseline data against which future surveys can be compared.

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[3]Bird species nomenclature follows American Ornithologists' Union (1983).

THE STUDY AREA

Lakes Poygan, Winneconne, and Butte des Morts cover an area of 76 km^2 at the confluence of the Wolf and Fox rivers in central Winnebago and eastern Waushara counties, Wisconsin (Fig. 1). A distance of 30 km separates the Village of Tustin, at the northwest end of the chain, from the City of Oshkosh (pop. 50,000) at the southeast end, where the lakes drain into Lake Winnebago via the Fox River. The surrounding area is gently rolling and primarily agricultural, the substrate consisting of Late Cambrian sandstones overlain by glacial drift and alluvial deposits.

Although formerly known for their abundant meadows, marshes, wild rice beds, and waterfowl, today the lakes consist of open water, generally 1-3 m deep, with riprap islands maintained for duck-hunting blinds, and a few scattered thin beds of phragmites (*Phragmites australis*)[1]. Emergent vegetation has gradually disappeared since the mid-1800's, when water levels were raised by the Fox River dams at the outlet of Lake Winnebago.

Several small marshes still exist along the shores, especially at the inlets of streams such as Pumpkinseed and Willow creeks, and the Pine, Wolf, and Fox rivers. Many of the marshes are protected from the open water by riprap barriers. Dense stands of cattails (*Typha* spp.) dominate most marshes. Scattered rows or patches of shrubs and trees, mostly dogwoods (*Cornus stolonifera*, *C. amomum*), willow (*Salix* spp.), cottonwood (*Populus deltoides*), and box elder (*Acer negundo*) also occur. There are occasional patches of more open or diverse marsh dominated by hardstem, softstem, and river bulrushes (*Scirpus acutus*, *S. validus*, *S. fluviatilis*), cattail, sedges (*Carex* spp.), burreed (*Sparganium* spp.), and/or phragmites. Poygan Marsh Wildlife Area, at the mouths of the Pine River and the Willow and Pumpkinseed creeks, is the only public property in the study area, aside from the lake itself. Along the Pine River in this Wildlife Area is a ca 200-ha tract of lowland hardwoods, including a stand of southern wet-mesic forest (cf. Curtis 1959) dominated by silver maple (*Acer saccharinum*), red maple (*A. rubrum*), and basswood (*Tilia americana*), and a stand with more northern affinities dominated by black ash (*Fraxinus nigra*), alder (*Alnus rugosa*), and silver and red maples.

METHODS

On 10 May, 1984, Mossman, David Dunsmore, and Wisconsin Department of Natural Resources (WDNR) pilot Jeff Heide conducted a fixed-wing aerial survey of the entire area, 0730-0930 hr, recording the locations of terns, gulls, cormorants, and potential nesting sites.

On 18 May, Mossman and Matteson surveyed most islands and several shore and marsh areas by motorboat, 1010-2040 hr. We inspected each area (except for the Scotts Bay island) for gull and tern nests.

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[1]Plant species nomenclature follows United States Department of Agriculture (1982).

Mossman and Hartman conducted canoe surveys of the remaining islands and most marshes during the 1984 breeding season; one canoe survey was also run during 1983 (Table 1, Fig. 1). We did not visit some of the smaller marshes in the area. During canoe surveys we attempted to estimate accurately the total numbers of nesting gulls and terns on all islands and marshes visited. We also attempted to locate nests of other species and to record all birds seen or heard. We estimated numbers of nesting pairs of black terns by identifying distinct sites from which birds flushed when we approached; however, for survey data presented in Table 6, we counted only those terns observed prior to flushing birds from nests.

Techlow and Katherine Rill installed 220 artificial nesting platforms for Forster's terns at 5 sites in the study area during 19 April-4 May 1984. Techlow inspected 199 platforms on 11 May, 200 platforms on 31 May and all platforms on 21 July. On 28 June and 11 July he counted numbers of adults and young within 4 of the 5 colonies. He also visited the 2 Forster's tern colonies on natural substrates.

Detailed notes on routes, methods, and observations are maintained in the files of the Bureau of Endangered Resources in Madison.

RESULTS

Double-Crested Cormorant

Cormorants did not nest in the study area, but nonbreeders were seen throughout the spring and summer. On 10 May we noted ca 50 cormorants on Courtney-Plummer Island and 12 swimming in phragmites islands in northcentral Lake Poygan. On 18 May we noted 1 at Sunset Bay, 13 on riprap and water south of Lone Willow Island, and 56 swimming on Lake Poygan near the mouth of the Wolf River. At twilight (2040 hr) on 18 May, we saw at least 40 cormorants flying above the north end of Courtney-Plummer Island, evidently preparing to roost; others may already have roosted.

Ring-billed Gull

We found a colony of 327 nesting pairs on the north end of Courtney-Plummer Island on 18 May, with an average clutch size of 2.58 (Table 2). This species is highly colonial and thus unlikely to nest singly or in small groups. We are fairly certain that none others nested in the study area. We have no information on this species' past nesting status here.

Herring Gull

We recorded 95 herring gull nests at a total of 17 sites in the study area (Table 2). Of 65 active nests with eggs, clutch sizes ranged from 1-5 ($\bar{x}$ = 2.60). One (unsuccessful) nest stood 2 m above water atop the roots of a blown-over willow tree at the boundary of marsh and lake; one occupied a small islet of mud and emergent vegetation (possibly atop a base of rock or riprap); and a third lay on a muskrat house at the boundary of marsh and lake.

The remaining 92 nests were on riprap islands built or substantially modified by humans; all of these islands contained 1 or more duck blinds. Two of these nests were atop hay bales used as protection for duck blinds and the others occurred on riprap or the rock-and-soil substrate of islands. Several were found within or on top of riprap duck blinds. On Courtney-Plummer Island, 31 nests occurred along the riprap edge of the southern three-quarters of the island and 2 occurred at the northern end within the ring-billed gull colony.

We have no information on previous nesting of this species in the study area except that we saw 2 downy young swimming from Courtney-Plummer Island on 19 July 1983.

Common Tern

In the early 1960's, Jack Kaspar (pers. comm. and in litt. April 1984) found a nesting colony of ca 20-25 pairs of common tern on a rocky island north or northeast of Terrell Island, probably on either Courtney-Plummer or Bare Islands, and another colony of at least 20 pairs nesting on a rocky island off the south shore of Lake Poygan or Lake Winneconne; this was not Lone Willow Island, but was evidently an island 1.5 km west of Harper's Point (T19N R15E S.7). This island has now almost disappeared, but it was larger at that time according to a 1961 USGS topographic map. It held a single herring gull nest in 1984 (Table 2).

We saw only 3 common terns during our breeding season surveys; these birds loafed among Forster's terns and shorebirds on a mud flat of Terrell Island. No common terns were seen or heard among nesting Forster's terns at any of the colonies. We checked all possible nesting sites and conclude that the species did not nest here in 1984.

Forster's Tern

In 1984, 312 pairs of Forster's terns nested within the study area; 219 of these occupied artificial nest platforms.

WDNR personnel placed a total of 220 platforms (Linde and Techlow 1982, Techlow and Linde 1983) in phragmites islands at 5 locations (Table 3, Fig. 1). Terns were perching on most platforms in each area when viewed from the air on 8 May. On 11 May, 8 of the 199 platforms in the Clark's Point and Lake Poygan colonies contained nests with incomplete clutches. On 18 May we found birds perched or incubating eggs on nearly all platforms; we replaced a platform
swept away in early May. On 31 May the 200 platforms in the Clark's Point and

Lake Poygan colonies contained a total of 199 nests and 631 eggs ($\bar{x}$ = 3.17 eggs per nest) (Table 3). An 11-egg nest and at least 1 of the 5-egg nests evidently included eggs from more than one adult. Excluding these 2 nests, mean clutch size for 197 nests was 3.12. No birds nested on the platform that we replaced at the Clark's Point-North colony on 18 May.

On 18 May we found nest structures on nearly all Terrell Island platforms, and on both 18 May and 21 June there were 1-2 adults on each platform. We believe Forster's terns nested on all of the 20 platforms at this site.

The estimated date of first hatching was 4 June. We first noted fledged young on 28 June. On 21 July, a check of all 220 platforms in the study area revealed 21 nests with a total of 41 eggs, at least some of which were still being incubated; 28 eggs outside of nests; 16 chicks, all less than a week old; 1 dead chick; and 3 dead fledglings. There was no sign of egg predation; nearly all eggs appeared to have hatched.

It is difficult to estimate the number of young fledged, for families scatter shortly after fledging. During mid-July in 1982-84 we often saw adults with fledged young within 30 km of the study area. These birds were almost certainly from the Poygan-Winneconne-Butte des Morts colonies.

On 11 July we counted at least 76 fledged young at the 4 Poygan and Clark's Point platform sites. On 21 July we counted 15 at the Terrell Island colony. The sum of 91 birds represents a minimum of the number of young produced (0.42/nest), because some young were not yet flying, others probably remained hidden while perched on platforms, and some had certainly dispersed. The actual fledging success of the platform colonies was probably closer to 1.0 or 1.5 young per nest, as indicated at the Clark's Point-South colony where a thorough search at the approximate time of fledging revealed 17 fledglings from 11 nests.

Whereas platform colonies were fairly successful, the 2 colonies on natural substrates were not productive. At Scotts Bay, Forster's terns nested on an island (ca 15 x 40 m in size) composed of exposed mud, burreed, cattail, and softstem bulrush. Fifty birds were seen here on 4 May. On 18 May 55-70 Forster's terns were present on the island, and we saw several nests in the one small section inspected. On 28 May 110 birds flushed from the island, and there appeared to be more nests than on 18 May: we recorded 25 active nests (some of unknown clutch size) from a single vantage point and estimated a nesting population of 70 pairs. Walking on this island is treacherous and slow, and in order to avoid prolonged disturbance to the colony we did not attempt a thorough nest count. The colony had evidently been largely abandoned by 21 June when we noted only 2-3 Forster's terns in the area. On 25 June we visited the island and found no Forster's terns. On 13 July we saw 3 adults and 6 fledged immatures in the area, all probably from nearby platform colonies; a walk through half the colony revealed 30 inactive nests and several broken shells. The cause of abandonment is not known.

The second colony on natural substrate occurred along the Wolf River channel at Boom Bay. Here, Forster's terns nested on muskrat lodges and mats of rhizomes on one end of a 30 x 150-m island of cattail, river bulrush, softstem bulrush, burreed, and Sagittaria. Nesting was just beginning on 18 May, when a thorough search revealed only 2 nests. On 2 June a thorough search revealed 21 active nests. Terns were still apparently nesting when we visited on 13 June, but the colony had been abandoned by 28 June when we found no birds present. We did find eggs that had been crushed, broken, or punctured, but no dead birds. We suspected mammalian predation, probably by mink.

The only other Forster's tern nests on natural substrate were the 2 found on a single muskrat lodge in a phragmites bed just south of Terrell Island. We did not visit the nests after their initial discovery on 18 May.

Forster's terns fed in many areas outside the nesting colonies, most consistently at Nickels Marsh, the mouths of Willow and Pumpkinseed creeks, the Boom Bay/Wolf River marshes, and along the Wolf River as far as Partridge Lake. We saw adult birds carrying minnows in these areas, evidently returning to nesting colonies as far away as 10 km.

Recent nesting of Forster's terns at certain traditional sites in the study area has been well documented (Table 4) (A. F. Linde in Hine and Tilghman 1978, and in litt. 1983, Harris and Trick 1979, Linde and Gierke 1980, Linde and Otto 1981, Linde and Techlow 1982, Techlow and Linde 1983). Forster's terns have been seen in the study area during the breeding season since at least the early 1960's (Thomas Erdman, pers. comm.; Tessen, Passenger Pigeon 35:96. 1973). According to local tales, anglers smashed the eggs of "white terns" (probably Forster's) in the phramites beds of Lake Poygan more than 30 years ago. However, nesting was not documented until 1977. In that year, 15 nests were found at the Sunset Bay, but the colony of 20-25 pairs was destroyed by wind and wave action. Crude artificial nesting platforms were placed there in 1978, and a single pair nested unsuccessfully. Platforms were placed in Sunset Bay in 1979, but no terns nested. No platform placement or nesting has occurred there since.

In 1979, ca 85 pairs attempted to nest on mud flat islands in Scotts Bay but abandoned the colony, evidently as a result of mammalian predation. No nesting occurred in Scotts Bay in 1980 (when a few platforms were installed) or 1981. About 60 pairs nested there on natural substrates in 1982 with at least some success. In 1983 a colony of ca 100 nests was abandoned, evidently because of mammalian predation.

Artificial platforms have been placed among phragmites beds in one or more of the "E", "WW" and "W" (adjacent to "WW") sites of Lake Poygan every year since 1980. Successful nesting has occurred at these sites on platforms every year, and also on mud flats and/or phragmites mats in 1980, 1981, and 1982.

Forster's terns were first known to have nested at the Clark's Point phragmites beds after placement of platforms in 1982, and they nested there successfully in both 1982 and 1983. At Terrell Island, the only known nesting prior to 1984 was in 1982, when one pair nested on a platform. No platforms or nesting occurred there in 1983.

Black Tern

We surveyed approximately 90% of the study area's potential black tern nesting habitat and recorded a total of 145 nesting pairs in 9 colonies (Table 5). We saw 44 active nests, with 1-3 eggs each ($\bar{x}$ = 2.56). A few pairs possibly nested in small unsurveyed marshes on the northeast shore of Lake Winneconne, or in the Miller's Landing area on the southeast shore of Lake Butte des Morts.

Colonies generally occurred at sites with a mixture of emergent vegetation, mud flats, and open water. Burreed was dominant or co-dominant in every colony, while cattail (which dominated most of the marshes) occurred only occasionally. Plant species occurring within 2 m of 39 nests were burreed (92% of nests), Eleocharis spp. (46%), softstem bulrush (23%), river bulrush

(13%), cattail (10%), bluejoint (Calamagrostis canadensis) (3%), and Carex spp. (3%). Most nests were built on mats of floating stems from previous years' emergent vegetation, or floating mats composed of a combination of mud, rhizomes, and dead stems. Two were found on dilapidated muskrat platforms.

The Wisconsin Black Tern Survey (Bureau of Endangered Resources files) produced many summer records for black terns in the various bays, marshes, and stream inlets of the study area for the period 1979-82. Although most of these sites are not used for nesting, many are used regularly for feeding. Observers have also found congregations of up to 100 birds after the breeding season, in July and August. Historic records for black terns are scant for the study area, but they indicate that the species was a common summer resident in the study area during the 1940's (Warren Dettman, M. J. Overton, R. N. Auchetoff in Milwaukee Public Museum files).

Our only nest records previous to the current study involve 3 nests found in the Miller's Landing area on 1 July 1981 (Anita C. Carpenter in litt.) and 5 nests found on Sunset Bay on 10 July, 1983 (Clark Schultz in litt.). These latter nests represent 6-7 pairs that began nesting late in the year; black terns did not attempt to nest here in subsequent years (op cit.).

Other Species

We recorded a total of 87 bird species during the period 27 May - 7 June (Tables 1, 6). Seventy-seven of these probably nested within the study area, 3 species probably nested nearby, and 7 species were represented by apparent nonbreeders.

We noted several great blue herons, black-crowned night-herons, and green-backed herons. The last species almost certainly nests within the study area, but we found no colonies of great blue herons or black-crowned night-herons during ground or aerial surveys, which included a thorough aerial search of the forested Pine River bottoms. There are no recent or historic heron rookeries recorded for the study area. Great blue herons seen on the study area might have nested at the nearest known active rookery near Cincoe Lake 20 km upstream along the Wolf River in Waupaca County. The caretaker of the Fox River Hunt Club (pers. comm.) found 1-3 pairs of "shitepokes" nesting in willow trees near the clubhouse on Lake Butte des Morts (T19N R15E S.27 SW) in 1984. His description suggested that these were black-crowned night herons.

A unidentified (tundra or trumpeter) swan was seen from a distance in Scotts Bay on 28 May and 5 June. If a tundra swan, it was undoubtedly a nonbreeding individual that had lingered at this traditional migration stopover area. However, the bird flew well, suggesting that it may have been a trumpeter, possibly a product of recent reintroductions in Minnesota. Mallards were common. We found 3 nests and 3 broods of mallard, 5 nests of American black duck, and 4 nests that may have belonged to either species. All black duck nests were on riprap islands.

The only northern harriers seen were a pair making an aerial food exchange on 1 June over a marsh north of the Pine River, where they appeared to be nesting. Techlow found 4 broods of common moorhens in 1983 and a brood of 5 on 11 July 1984, all in Lower Boom Bay Marsh.

Sandhill cranes, rare in Wisconsin only a few decades ago, were common and appeared to be nesting in most of the marshes within the study area in 1984. Of the 48 recorded, most were engaged in unison calls. On 2 June we found 5 pairs in Lower Boom Bay Marsh alone, and saw an adult with a chick 1-2 weeks old in Upper Boom Bay Marsh. Nonbreeding cranes also occur in the study area: at Scotts Bay we saw a group of 10-11 cranes on 5 June, 25 June, and 13 July; 40 were seen on Lake Poygan on 2 May. The area may also serve as a fall staging area, as indicated by 200+ birds seen on Lake Poygan on 16 September.

The solitary and semipalmated sandpipers recorded in early June were nonbreeders. Spotted sandpipers were found at 2 sites in May and 1 site in June; they apparently nest here sparingly.

We found 1 yellow-bellied sapsucker in lowland hardwoods along the Pine River and consider it a probable nester. Along a feeder stream in these same woods an acadian flycatcher was singing in wet-mesic forest dominated by basswood and silver maple. Although we searched unsuccessfully for a nest or female, the site was characteristic of the species' breeding habitats in Wisconsin. Eastern kingbirds were common among the scattered trees and shrubs of marshes; we recorded a nest in a dead willow sapling on Lone Willow Island.

The 3 brown creepers found along the Pine River were in southern wet-mesic hardwoods typical of the species' breeding habitats in southern Wisconsin, and we assume they nested at this site. Wood thrushes and veeries both certainly nest in this same tract--we found the former only in southern wet-mesic hardwoods and found veeries in the same habitat as well as in the adjacent black ash-alder swamp. American robins also occurred in both habitats and a nest was found in an alder. One tin wood duck nest box in the Pine River Woods contained vocal European starling nestlings.

Yellow-throated vireos and American redstarts occurred in the Pine River woods and in smaller tracts of woods surrounded by marsh. One cerulean warbler was recorded in the Pine River silver maple-basswood tract where it probably nested. We found 1 singing northern waterthush in an ash-alder swamp and another silent bird nearby, and consider it likely that the species is nesting here. Five singing mourning warblers were in shrubby openings in the Pine River southern wet-mesic woods, evidently breeding.

Yellow-headed blackbirds nested in most of the study area's marshes. On 2 June we recorded 2 nests with 4 eggs each, in cattails at Lower Boom Bay Marsh. Techlow found many nests and fledglings in Lake Poygan phragmites islands during 1982-84.

Red-winged blackbirds were nearly ubiquitous, nesting commonly even on the larger riprap islands (e.g., ca 15 territories on Courtney-Plummer Island). We recorded 5 nests at Courtney-Plummer Marsh and a nest on Necklace Island. Common grackles nested in a variety of situations: 0.6 m above water in cattails of a cattail marsh, 300 m from the nearest trees; 1.5 m above water in alder and red osier at the border of marsh and woods; 4.5 m up in a

sapling; 6 m up in a willow tree on Lone Willow Island. Flocks composed of hundreds of (apparently nonbreeding) yellowheads, redwings, and grackles were noted roosting in cattails at Pumpkinseed Creek on the evening of 27 May and in a phragmites island in Sunset Bay on 7 June.

DISCUSSION

This survey documents several important breeding bird populations and associated habitat features of the Lake Poygan-Winneconne-Butte des Morts area. Perhaps foremost in importance are the breeding colonies of Forster's terns. In recent years these colonies have accounted for more than half of the entire state's nesting population. The persistence of these colonies is largely attributable to the development and use of artificial nest platforms. Almost all attempted nestings on natural substrates in the study area have had little or no success because of mammalian predation or wind and wave activity. Natural nesting sites are few and generally of dubious quality, and it is essential that the nest platform program continue. However, isolated beds of emergent vegetation such as phragmites and sagittaria must also be maintained at platform sites to provide protection for chicks against predators and wave action. These beds are remnants of the extensive marshes that occurred here before the artificial elevation of lake levels by the dams at Neenah and Menasha. Many have been shrinking since at least the 1930's and continue to do so because of continuing high water levels and possibly the activities of boaters and snowmobilers (Sunday Northwestern 6 February 1983).

Also significant in the study area are the breeding populations of gulls. The 95 pairs of herring gulls represent the state's largest known inland nesting concentration, while the ring-billed gull colony on Courtney-Plummer Island is the only known inland colony for Wisconsin. Both species nest in fairly large numbers along Lake Superior and in the Green Bay area. Ring-billed gulls have increased dramatically in the western Great Lakes since 1965 and have usurped several colony sites of the common tern. Every major, recent common tern colony in Wisconsin has been invaded by this species, except for the "Friendship" tern colony on nearby Lake Winnebago. The discovery of the Courtney-Plummer Island ring-billed gull colony suggests the need for careful monitoring of the Friendship colony for early signs of invasion.

Common terns were known to nest in at least 2 sites in the study area ca 20 years ago, prior to the regional invasion by ring-billed gulls. We do not know when ring-billed gulls began nesting here, nor when common terns ceased to nest, but it is possible that common terns, which nested at either Courtney-Plummer or an adjacent island, were supplanted by ring-billed gulls. A second historic common tern nesting island in the study area has nearly disappeared because of erosion. The only islands in the study area still suitable for nesting by common terns are Courtney-Plummer and 2 marginal sites, Bare and Necklace Islands. However, the presence of established colonies of ring-billed or herring gulls at all 3 sites, and the near absence of common terns in the study area during the breeding season, argue against any likelihood of reestablishing a common tern colony here in the near future. The thought should not be totally abandoned, however. Common terns do still visit the area occasionally and nonbreeders and post-breeders are found just outside the study area along Lake Winnebago, especially in Miller's

Bay at Oshkosh. The species might eventually be reestablished in conjunction with a program to discourage gull nesting and to improve and enlarge potential nesting islands with dredge spoils, riprap, and/or gravel. Until then, periodic monitoring of gull and tern populations should continue.

The regular occurrence of nonbreeding double-crested cormorants in the study area suggests that a sufficient food supply exists to support at least a small colony of this threatened species. We feel, however, that there are no available sites in which to erect artificial nesting platforms sufficiently removed from human disturbance. It is possible that cormorants could nest at Courtney-Plummer Island and periodic monitoring should continue at this site.

Of the 9 "watch" species recorded, all but the black-crowned night-heron and great blue heron evidently nested on the study area, including American black duck, northern harrier, black tern, acadian flycatcher, yellow-throated vireo, cerulean warbler, and black-and-white warbler. Black duck populations are declining throughout much of the species' breeding range, including Wisconsin, because of habitat loss, inter-breeding with mallards, and over-harvest (Tate and Tate 1982, Feierabend 1984). Their nesting on Lake Butte des Morts islands and their occurrence in the Pine River Swamp is significant, particularly for the southern half of the state.

The acadian flycatcher, yellow-throated vireo, cerulean warbler, and black-and-white warbler are all on Wisconsin's "watch" list because of their restricted distribution and apparent dependence on large tracts of forest in southern Wisconsin. In the study area these species occurred almost exclusively in the Pine River bottoms. The significance of this wooded tract is strengthened by the occurrence of several other breeding birds that are rare in the Winnebago-Waushara county area. The brown creeper and the yellow-bellied sapsucker are characteristic of large tracts of southern lowland hardwoods, and the northern waterthrush is characteristic of wooded swamps farther north. Along with the breeding populations of barred owl, veery, mourning warbler, American redstart, and black duck, the presence of these species suggests that the forested Pine River bottomlands are worthy of protection.

CONCLUSIONS

Several significant populations of breeding birds within the study area are worthy of protection, management, and/or continued monitoring. We recommend the following:

1. Continue annual maintenance, placement, and monitoring of at least 200 Forster's tern nest platforms in the study area; annually monitor formerly-used or other potential natural nesting sites. Monitoring should include a minimum of 3 annual visits at times of egg-laying, late incubation, and early fledging, respectively.

2. Visit Courtney-Plummer Island each year in mid to late May to count nests of ring-billed and herring gulls, and waterfowl, and to look for evidence of breeding by other colonial species such as common tern and cormorant.

3. Protect the Pine River bottoms (T19N R13E S.14,15) from logging or other major disturbance, in order to maintain breeding bird communities of these lowland hardwood forests.

4. Protect shoreline marshes to maintain the diversity of marsh birds such as black tern, harrier, herons, and bitterns. Discourage human disturbances that damage islands of phragmites and other emergent vegetation in known or potential Forster's tern nesting areas. Manage Lake Winnebago system water levels to expand shoreline and island marshes.

5. Encourage the upkeep and expansion of riprap islands to provide colonial bird nesting sites, and consider the creation of new sites from dredge spoils if feasible.

6. Repeat the 1984 survey every 5-10 years to monitor bird populations and habitat conditions.

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TABLE 1. Breeding bird surveys conducted on Lakes Poygan, Winneconne, and Butte des Morts, 1983-84.

Date	Area	Time	Observer
11 July 1983	Willow Creek - Pumpkinseed Creek	0940-1110	MM
27 May 1984	Pumpkinseed Creek	1900-2056	MM
28 May 1984	Nickels Marsh	0710-1155	MM
28 May 1984	Courtney-Plummer Marsh	1346-1803	MM
28 May 1984	Harper's Point Marsh	1900-1946	MM
1 June 1984	Pine River - Willow Creek Area	1035-2130	MM, LH
2 June 1984	Boom Bay Marsh	0708-1600	MM, LH
2 June 1984	Boom Bay Heights Residential	1650-1700	MM, LH
2 June 1984	Clark's Point Wetland	1902-2030	MM, LH
4 June 1984	Lone Willow Island & Marsh	1725-1838	MM
5 June 1984	Terrell Island Marsh	1247-1512	MM
7 June 1984	Sunset Bay	2030-2115	MM, LH

TABLE 2. Gull nests found during 1984 survey of Lakes Poygan, Winneconne, and Buttes des Morts, Wisconsin.

Site	Legal Description*	Island Dimensions (m)	Substrate	Date	Total No. Nests	No. Nests of Each Clutch Size 0	1	2	3	4	5	Nests With Chicks**
Herring gull												
Bee Island	T18N R15E s.2 ne	4 x 9	Riprap	18 May	1	0	0	0	1	0	0	0
Bare Island	T19N R15E s.36 nw	14 x 20	Riprap	18 May	1	0	0	1	0	0	0	0
Courtney-Plummer Island	T19N R15E s.26 se	20 x 200	Riprap	18 May	33	4	3	6	17	0	1	2
Horseshoe Island	T19N R15E s.26 se	20 x 30	Riprap	18 May	7	0	0	0	6	0	0	1
Unnamed Island	T19N R15E s.35 ne	2 x 4	Mud	18 May	1	-	-	-	-	-	-	-
Fox River Inlet	T18N R15E s.3 nw	2 x 2	Muskrat house	28 May	1	-	-	-	-	-	-	-
Nickels Marsh	T19N R15E s.27 sw	16 x 18	Hay bale	28 May	1	0	0	0	1	0	0	0
Unnamed Island	T19N R15E s.7 e 1/2	2 x 4	Riprap	18 May	1	-	-	1	-	-	-	-
Lone Willow Island	T19N R14E s.12 se	----	Riprap barrier	18 May	1	1	0	0	0	0	0	0
Unnamed Island	T19N R14E s.35 n 1/2	3 x 7	Riprap	18 May	2	-	-	-	-	-	-	-
Fist Island	T19N R14E s.35 n 1/2	25 x 40	Riprap	18 May	8	2	0	2	3	0	0	1
Unnamed Island	T19N R14E s.35 n 1/2	3 x 6	Riprap	18 May	1	0	0	0	1	0	0	0
Unnamed Island	T19N R14E s.35 n 1/2	4 x 4	Riprap	18 May	1	-	-	-	-	-	-	-
Necklace Island	T19N R14E s.34 ne	15 x 20	Riprap	18 May	33	1	3	6	13	0	0	10
Boom Bay	T19N R14E s.26 sw	-------	Tree tip-up	18 May	1	-	-	-	-	-	-	-
Willow Creek Mouth	T19N R13E s.13 sw	-------	Riprap barrier	1 June	1	1	0	0	0	0	0	0
Horsetrough Island	T19N R13E s.12 sw	9 x 16	Hay bale	1 June	1	0	0	0	0	0	0	1
				Total	95	9	6	16	42	0	1	15
Ring-billed gull												
Courtney-Plummer Island	T19N R15E s.26 se	20 x 200	Riprap, soil	18 May	327	7	29	60	230	1	0	0

*R14-15E are in Winnebago County. R13E is in Waushara County.
**These nests not included in clutch size data.

TABLE 3. Forster's tern nest data for Lakes Poygan, Winneconne, and Butte des Morts (Winnebago County, Wisconsin), 1984.

Site	Legal Description	Substrate	No. Pairs Attempting To Nest	Success	No. Nests Of Indicated Clutch Size											
					18 May					Later Date						
					0	1	2	3	4	0	1	2	3	4	5	Date
Terrell Island	T19N R15E s.36 se	20 platforms	20	Good	15	5	0	0	0	-	-	-	-	-	-	(No visit)
Terrell Island	T19N R15E s.36 sw	Muskrat house	2	Unknown	0	2	0	0	0	-	-	-	-	-	-	(No visit)
Scott's Bay	T19N R15E s.34 ne	Burreed island	70	None	0	4	0	3	0	4	2	5	11	0	0*	(28 May)
Clark's Point South	T19N R15E s.7 nw	11 platforms	11	Good	1	2	3	5	0	0	0	1	7	3	0	(31 May)
Clark's Point North	T19N R15E s.6 sw	86 platforms	85	Good	26	23	14	22	0	0	0	5	74	6	0	(31 May)
Poygan "E"	T19N R14E s.1 nw	48 platforms	48	Good	13	12	9	3	1	0	0	1	34	11	1**	(31 May)
Poygan "WW"	T19N R14E s.2 ne	55 platforms	55	Good	21	13	9	12	0	0	0	4	38	11	2***	(31 May)
Wolf River	T20N R14E s.27 e	Cattail island	21	None	0	1	0	0	0	0	0	5	16	0	0	(2 June)
		Total	312													

*Complete nest count not attempted.
**Also 1 clutch of 11 containing eggs from more than 1 bird.
***One 5-egg clutch contained eggs from more than 1 bird.

TABLE 4. Estimated number of breeding Forster's tern pairs on Lakes Poygan, Winneconne, and Buttes des Morts, Wisconsin.

Site	1977	1978	1979	1980	1981	1982	1983	1984
Sunset Bay	20-25	3	0	0	0	0	0	0
Terrell Island	0	0	0	0	0	1	0	22
Scotts Bay	-*	-	85	0	0	60	100	70
Clark's Point	0	0	0	0	0	21	97	96
"E", "W", "WW" area	0	0	0	20+	156	287	148	103
Wolf River	-	-	-	-	-	-	-	21
Total	20-25	3	85	20+	156	369	345	312

*Unknown.

TABLE 5. Black tern nest data for Lakes Poygan, Winneconne, and Butte des Morts, Wisconsin, 1984.

Site	Legal Description*	Date	Number Nesting Pairs	Number Nests of Each Clutch Size** 0	1	2	3
Terrell Island	T19N R15E s.35 s1/2	5 June	57	-	-	-	2
Nickels Marsh	T19N R15E s.34 sw	28 May	33	-	2	-	13
Courtney-Plummer Marsh	T19N R15E s.27 nw	28 May	3	0	0	1	2
Harper's Point Marsh	T19N R15E s.17 se	28 May	15	-	3	2	5
Boom Bay Marsh	T20N R14E s.26 sw	2 June	10	-	-	2	1
Boom Bay Marsh	T20N R14E s.26 ne,27 nw	2 June	6	-	-	-	3
Boom Bay Marsh	T20N R14E s.22 se	2 June	4	-	-	1	1
Boom Bay Marsh	T20N R14E s.22 ne,23 nw	2 June	15	-	1	1	3
Poygan Marsh. W.A.	T19N R13E s.11 ne	1 June	2	0	0	1	1

TABLE 6. 1984 breeding bird survey results, for Lakes Poygan, Winneconne, and Butte des Morts, Wisconsin.

Species	Number of individuals recorded in each area*												
	PC	NM	CP	HP	PR	LB	UB	BH	CL	LW	TI	SB	Total
Pied-billed grebe						1	1						2
Double-crested cormorant							1						1
American bittern	5			2	1	1	1		1	3			14
Least bittern	1		2		3	6			4				16
Great blue heron		1			17	4					1		23
Green-backed heron		4	2	1	2	1			1	1			12
Black-crowned night-heron	3				4	1							8
Tundra/Trumpeter swan		1											1
Canada goose										1			1
Wood duck					15	2			3		3		23
American black duck					2	2							4
Mallard		9	5		12	3	1		4	1	17	10	62
Blue-winged teal	3	3	8	2		5					4	2	27
Ring-necked duck			1										1
Northern harrier					2								2
Red-tailed hawk					1				2				3
American kestrel									1				1
Ring-necked pheasant	1												1
Virginia rail					1	3			2		1	1	8
Sora	1	6	1	1	2	2			3				16
Common moorhen		1		1		1							3
American coot	1	1	2		1	2	2					3	12
Sandhill crane	4	13	3		10	11	3		2		2		48
Killdeer					1	1					1		3
Solitary sandpiper					1								1
Spotted sandpiper					2								2
Semipalmated sandpiper											1		1
Common snipe		1	3			2			2				8
Ring-billed gull		9											9
Herring gull		13	5		3	18							39
Forster's tern	3	10	1	2	10	25		1	3	2	2		49
Black tern		6	9	11	10	36	12			2	50		136
Mourning dove					6				1	1			8
Yellow-billed cuckoo					2								2
Great horned owl									1				1
Barred owl					**								**
Common nighthawk	1				3				1				5
Ruby-throated hummingbird					1								1
Belted kingfisher		1											1
Yellow-bellied sapsucker					1								1
Downy woodpecker					2								2
Hairy woodpecker					1								1
Northern flicker			2		1		1		1				5
Eastern wood-pewee			2		7								9
Acadian flycatcher					1								1
Alder flycatcher	1												1
Willow flycatcher					2								2
Least flycatcher			3		1	2	1	2					9
Great crested flycatcher					21				2				23
Eastern kingbird			2		5	4			4	2			17
Purple martin			1		1	7	2	10	4	1			26
Tree swallow	+	6	10		31	13	5	1	8	2		1	77+
Bank swallow	+	3	2				2			1		3	11+
Cliff swallow			1				1						2
Barn swallow	+	2	7		3			7	2			2	23+
Blue jay					2		1		1				4
Brown creeper					3								3
House wren		1			8			1					10
Sedge wren	2	2			3								7
Marsh wren	40	27	18	4	43	175	90		9	13	19	11	449
Blue-gray gnatcatcher		1			8								9
Veery					6								6
Wood thrush					2								2

Table 6. Continued.

Species	Number of individuals recorded in each area*												
	PC	NM	CP	HP	PR	LB	UB	BH	CL	LW	TI	SB	Total
American robin		2	1		7	1		2	3				16
Gray catbird					8	1			3				12
Cedar waxwing									3				3
European starling			2		1			3	1				7
Yellow-throated vireo					5	1	2						8
Warbling vireo		1	5		1	9	2	4	5	4			31
Red-eyed vireo					2								2
Yellow warbler	1	7	7	1	29	8	4	1	7				65
Cerulean warbler					1								1
Black-and-white warbler					3								3
American redstart		1			26	2	3		1				33
Northern waterthrush					2								2
Mourning warbler					5								5
Common yellowthroat	4	7	5	2	33	14	6	1	4				76
Rose-breasted grosbeak					4								4
Song sparrow		3	1		37	7		2	4	4			58
Swamp sparrow	7	18	23	4	24	27	9		14	12	7		145
Red-winged blackbird	28	93	192	27	64	138	62	3	77	46	4	35+	805+
Yellow-headed blackbird	+	3		27		60	3		17	1	6	20+	137
Common grackle		3	4	2	4	17	2	14	13	4			63
Brown-headed cowbird						1			1				2
Northern oriole		1	1		6	1	1	2					12
American goldfinch			3		2	1							6
House sparrow								6					6

*PC = Pumpkinseed Creek, NM = Nickels Marsh, CP = Courtney-Plummer Marsh, HP = Harper's Point Marsh, PR = Pine River-Willow Creek area, LB = Lower Boom Bay Marsh, UB = Upper Boom Bay Marsh, BH = Boom Bay Heights Residential, CL = Clark's Point Wetland, LW = Lone Willow Island Marsh, TI = Terrell Island Marsh, SB = Sunset Bay Marsh.

** = recorded after survey on 1 June.
+ = flocks of apparent nonbreeders also observed.

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Typical Lake Butte des Morts shoreline, with cottage, willows, and cottonwoods. 5 June 1984.

Ring-billed gull colony on north end of Courtney-Plummer Island. 18 May 1984.

Herring gull nest and duck blind on unnamed riprap island, T19N R14E S. 35 n 1/2. 2 June 1984.

Herring gull chick on nest atop hay bale, Horsetrough Island. 1 June 1984.

Forster's tern nesting platforms among phragmites, Clark's Point-North site. 18 May 1984.

Forster's terns at 2 nests on muskrat lodge, Terrell Island. 18 May 1984.

Forster's tern nests, Wolf River site. 2 June 1984.

Northern waterthrush habitat--black ash swamp along the Pine River. 1 June 1984.